The Role of Leptin in Appetite Suppression and Satiety

With the increasing prevalence of obesity in America, there has been more emphasis on uncovering just what controls hunger, appetite, and satiety. A number of hormones and neurotransmitters have been linked to a person’s level of appetite and hunger. Leptin is one hormone that has been connected with appetite suppression in the body. While also implicated in the neural functions, bone mass, and reproduction, for nearly the past twenty years, this protein hormone has been investigated for the significant roll that it plays in satiety, energy balance, obesity, and weight loss and management.

Leptin is a hormone produced by adipose tissue, and works to regulate energy homeostasis by impacting a person’s amount of food intake and body weight. Leptin controls satiety because it is able to cross the blood-brain barrier to suppress satiety sensations produced by the hypothalamus. It inhibits appetite by counteracting the effects of neuropeptide Y and anandamide, two potential appetite stimulators, and also by promoting the synthesis of a-MSH, an appetite suppressent. Since leptin is produced in adipocytes, it essentially communicates to the brain how much fat is present in the body because it circulates in the blood at levels proportional to body fat; as body fat stores increase, higher levels of circulating leptin act to suppress appetite and promote energy utilization (Feng et al. p. 34). As leptin levels increase, appetite decreases and metabolic rate also rises. However, similar to insulin resistance in type two diabetes, leptin resistance can result from enlarged adipose stores and persistently high leptin levels, known as hyperleptinemia or hypothalamic
leptin insensitivity. Leptin resistance first appears in the brain, where receptors essentially become unable to interpret leptin levels, and therefore cannot stimulate metabolism or suppress appetite. A person consequently lacks the feeling of satiety and continues to eat (Cashin-Garbut, 2002). Since obesity is due to the combined effects of genes, environment, and lifestyle, leptin resistance is thought to be caused by a combination of diet and lifestyle choices, such as lack of physical activity, stress, inadequate sleep, and a diet high in fructose. It has also been suggested that there exists a genetic component in leptin resistance tied to defects in the leptin receptor (LEPR) gene, where the brain is misinformed about fat stores amounts and energy balance, causing hyperphagia resulting in obesity (Feng et al., p. 34). One study looked at this relationship between leptin and genetics. Significant differences in the genotype and allele frequency of the leptin receptor gene were found between obese and normal weight women in Saudi Arabia, supporting the hypothesis that alterations in the leptin signaling system could contribute to the obesity (Daghestan et al. p. 290).

Whatever the reason for leptin resistance, high levels of circulating leptin in the blood are consistently associated with obesity. When leptin was first discovered, many researches thought that leptin replacement therapy could be given to obese people and to cause them to stop overeating. However, this was found not to work because the problem in obesity is with leptin resistance, not leptin deficiency. Leptin replacement therapy has only been found to be beneficial in improving glycemic control and decreasing triglycerides in those with lipodystrophy (Oreal et al., 2002).

It has also been suggested that leptin is not so much a satiety signal but a starvation signal notifying the body to maintain current fat stores (Feng et al., p.36). This implication is
especially important when the role of leptin in weight loss and obesity is examined. While many people assume that drastically low calorie diets will allow them to lose weight, blood levels of leptin fall when fat stores are decreased during times of fasting, extreme dieting, lipodystrophy, and uncontrolled type one diabetes (Leifheit-Nestler et al., p.4) When these levels fall, the hypothalamus is stimulated causing sensations of hunger and decreased energy expenditure, thus drastically low calorie diet are not thought to be beneficial. When dieting, whether or not leptin sensitivity can be restored when an obese person loses weight has also been investigated. In a research study that aimed to explore the efficiency of blood–brain leptin transport restoration, sheep were first fed high calorie diets so that their body fat percentages and body mass indexes would be equivalent to that of obese human males. The obese sheep were then put on low calorie diets to lose weight. Serum leptin levels were recorded when the sheep were both gaining and loosing weight. As the sheep become more overweight, their leptin concentration levels steadily increased, but as they lost weight, the efficiency of blood-brain leptin transfer was not restored, suggesting that the leptin signaling system seems more efficient at protecting against starvation than causing excessive weight gain or weight loss (Adam and Findlay, p. 986).

Since its discovery nearly twenty years ago, the extent of the role that the protein hormone leptin has in appetite suppression and satiety is still being discovered. It remains unknown whether leptin has more or less affect on appetite and satiety than other hormones and neurotransmitters in the body, but what is clear is the relationship between leptin and the hypothalamus and the affect that the hormone has on appetite, satiety, and energy balance.
Bibliography


